Electronic Version
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Description

Single Sheet Collecting Device for Stacking Sheets of Paper, Plastic or the Like

Background of Invention

[0001] 1. Field of the Invention.

[0002] The invention relates to a single sheet collecting device for stacking sheets of paper, plastic material, and the like, comprising at least one transport element, preferably several transport elements, in particular transport belts, further comprising at least one stop unit positioned in the transport path of the sheets, and further comprising at least one ramp member with which the sheets during transport can be lifted briefly out of the transport plane.

[0003] 2. Description of the Related Art.

[0004] Sheets that are to be stacked are stacked from the top or from below, depending on the feeding device. In this connection, the sheets are guided by means of transport ele-

ments that are preferably embodied as round belts across a ramp member and are stopped at a stop unit. Each following sheet is again guided across the ramp member and placed onto the preceding sheet or pushed underneath it. In this way, stacks with 10 or more sheets are formed. By actuating the stop unit, the complete stack is transported farther until it has left this unit. The stop units is then again stopped in order to form the next stack. When forming large stacks, there is often a displacement of the sheets. When starting the stop unit, it can happen that during the further transport one or several sheets are shifted relative to one another or even stay behind because they are not properly engaged. This occurs in particular when a servo motor is used for driving the stop unit and the stop unit is thus exposed to high accelerations.

SUMMARY OF INVENTION

[0005] It is an object of the present invention to configure a device of the aforementioned kind such that upon further transport of the stack a displacement or leaving behind of individual sheets is prevented.

[0006] In accordance with the present invention, this is achieved in that in the transport path of the sheets between the

ramp member and the stop unit at least one pressing device is provided with which the sheets of the stack are pressed against one another.

[0007] Because of the configuration according to the invention, the sheets of a stack or set stacked from the top or from below are compressed by the pressing device wherein the pressing force is selected such that a shifting of the individual sheets during the further transport of the stack is prevented, on the one hand, and such that, on the other hand, each set can be properly transported away from the stop unit at high accelerations.

Brief Description of Drawings

[0008] Fig. 1 shows in a schematic illustration a part of the device according to the invention in a side view.

[0009] Fig. 2 shows the device according to Fig. 1 in a view in the direction of arrow II of Fig. 1.

Detailed Description

[0010] The device 1 illustrated in the drawing is used to collect or stack sheets 2, preferably paper sheets, to form a stack or set. Subsequently, the sets are further processed in an after-processing device (not illustrated). The device 1 forming a collector has at the feed side and the exit side drive

rollers 3 to 6 of which only the rollers at the exit side are illustrated. Across the rollers 3 to 6, transport belts 7 to 12 are driven which are preferably formed as round belts. In the illustrated device 1, three rollers are provided above the transport plane for the paper sheets 2 at the feed side and at the exit side, respectively. The rollers at the feed and exit sides are aligned with one another in the transport direction P. Only the outwardly positioned rollers 3, 4 and 5, 6 can be seen in the drawing. About each one of the aligned roller pairs a transport belt 7 to 12 is guided, respectively.

[0011] The upper rollers 3, 4 and the lower rollers 5, 6 have the same spacing from one another. The spacing between the upper rollers 3, 4 is however greater than that between the lower rollers 5, 6. The central rollers (not illustrated) are positioned aligned with one another above one another while the laterally positioned lower rollers 5 and 6 are inwardly displaced relative to the upper outer rollers 3 and 4. By means of the transport belts 7-12, the paper sheets 2 are transported, as is known in the art, in the transport direction P through the device 1, wherein the sheets 2 are positioned between the transport belts. In the area between the transport rollers 3-6 positioned at the

feed and exit sides, stop rollers 13, 14 and 15, 16 are provided which form an adjustable stop unit for the paper sheets 2. The rollers 13, 14 are positioned above and the rollers 15, 16 underneath the transport plane of the sheets, wherein the rollers 13 and 15 and the rollers 14 and 16 are positioned above one another, respectively.

[0012] In the end view according to Fig. 2, the rollers 13, 15 and 14, 16 are positioned between the central rotors (not illustrated) and the lower lateral rollers 5 and 6. The rollers 13, 14 and 15, 16 have a smaller spacing relative to the lower lateral rollers than relative to the central rollers about which the transport belts 8 and 11 are guided. The upper and lower rollers 13, 14 and 15, 16 are driven in opposite directions, as is known in the art, and are stopped during stacking of the paper sheets 2.

[0013] The stop rollers 13 through 16 are resting against one another in the stop position illustrated in Fig. 1. In this way, the paper sheets 2 fed by the transport belts 7 through 12 cannot be transported father between the stopped stop rollers 13 to 16. The paper sheets 2 are stopped at the stop rollers and stacked. As illustrated in Fig. 1, the paper sheets 2 reach with the leading edge in the transport direction P the gap between the stop rollers

13 through 16 resting against one another and are stacked thereat. In the transport direction P, at a spacing upstream of the stop rollers 13-16, a ramp device 17 is provided which is formed, as is known in the art, as an inclined ramp. In a side view according to Fig. 1, it has approximately a trapezoidal shape and has in the transport direction P a planar ramp surface 17a ascending in the transport direction. It is positioned in the transport path of the paper sheets 2 and ensures that the sheets 2 are lifted in the area upstream of the stop rollers 13 to 16 with elastic deformation of the transport belts 7-12. In this way, it is possible to stack the individual paper sheets 2 at the stop rollers 13-16 because the trailing paper sheets, respectively, are guided onto the paper sheet that rests against the stop rollers 13-16. The ramp device 17 is comprised of several wedge elements that are arranged in the area between the transport belts 7-12 so that the paper sheets 2 are reliably lifted across their width.

[0014] Viewed in the transport direction P, between the ramp device 17 and the stop rollers 13-16 two pressure rollers 18 and 19 are provided that are positioned above one another. One pressure roller 18 is positioned above and the other pressure roller 19 is positioned below the transport

plane. Both pressure rollers are permanently driven, as are the transport belts 7-12. The upper pressure roller 18 is force-loaded transverse to the transport path. The lower pressure roller 19 serves as an abutment when the upper pressure roller 18 presses onto the stack 22 formed of paper sheets 2 in front of the stop rollers 13 to 16. Advantageously, the upper pressure roller 18 is spring-loaded by a spring. However, it can also be loaded, for example, by means of an adjusting device, against the transport plane.

[0015] The pressure rollers 18, 19 are comprised of a material with minimal coefficient of friction, preferably steel. The pressure rollers 18, 19 are positioned in the plane of the central transport rollers (not illustrated). Like the rollers 3 to 6, they have peripheral grooves 20, 21 for the central transport belts 8 and 11. The depth of the grooves 20, 21 is greater than the diameter of the transport belts 8, 11 so that the transport belts are completely recessed within the grooves. In this way, only the pressure rollers 18, 19 contact the paper sheets 2. The axes of the transport rollers 3 to 6 are positioned parallel to one another and are stationary (do not changed their position) during passage of the paper sheets 2. The axes of the lower stop rollers 15,

16 and of the lower pressure roller 19 do not change with regard to their position. The upper stop rollers 13, 14 and the upper pressure roller 18, on the other hand, are movable transversely to the transport plane so that these rollers 13, 14, 18 can be adjusted to the respective height of the paper stack 22.

[0016] The pressure rollers 18, 19 are positioned in the area between the stop rollers 13 to 16 and the ramp device 17 and exert a pressure onto the stack 22 comprised of paper sheets 2 without the stack being hindered with regard to later transport. By means of this pressure, the paper sheets will not slip relative to one another when, after stack formation, the stack 22 is transported farther by the stop rollers 13-16. In this way, it is possible in a simple way to transport thick or tall stacks without undesirable slipping or displacement of the paper sheets 2. This applies in particular also when the stop rollers 13 to 16 are accelerated very quickly, for example, by means of a servo motor.

[0017] In the transport direction P upstream of the pressure rollers 18, 19, an upper tensioning roller 23 and a lower tensioning roller 24 are provided. By means of the tensioning rollers, the transport belts 8, 11 are tensioned

such that they rest against the bottom of the grooves 20, 21 of the pressure rollers 18, 19 and reliably drive the pressure rollers.

[0018] At the beginning of stacking of the paper sheets 2 from the top, the first paper sheet is entrained by the transport belts 7–12 into the stop position at the stop rollers 13 to 16 (Fig. 1) that are at rest. During transport, the upper pressure roller 18 presses onto the paper sheet 2 that is transported in this way reliably to the stop rollers 13 to 16. The pressure rollers 18, 19 are advantageously adjustable for adaptation to different lengths of the paper sheets 2 in the transport direction P. The ramp device 17 is adjusted such that the paper sheet 2 in its stop position is positioned with the trailing edge 25 downstream of a vertically extending end face 26 of the ramp device 17. The ramp device 17 is also advantageously adjustable for adaptation to different paper sheet lengths in the transport direction P. When stacking from the top, the trailing paper sheet 2 moves onto the ramp surface 17a and is thus slightly deflected upwardly out of the transport plane. In this way, the lower strands of the upper transport belts 7 to 9 are elastically deflected upwardly so that the trailing paper sheet reaches reliably a position on the

previously transported paper sheet. By means of the elastically bent transport belts 7 to 9, the paper sheet 2 is then properly transported across the ramp device 17 onto the paper sheet 2 positioned underneath and is then transported farther in the area of the pressure rollers 18, 19 by the rollers 18, 19 to the stop position. In the same way, the following paper sheets 2 are also stacked on top. In the described way, all paper sheets 2 areacross the ramp device 17. As soon as the paper sheet stack 22 is formed, the stop rollers are set in motion again and the respective set is transported farther between the stop rollers 13 to 16. As soon as the stop rollers 13 to 16 are stopped again, the next set or stack 22 can be formed by stacking the paper sheets 2 from the top in the described way.

[0019] The upper pressure roller 18 loads the stack 22 such that it is properly engaged and entrained by the stop rollers 13 to 16 without the paper sheets 2 slipping accidentally relative to one another. The pressing force is smaller then static friction of the sheets within the stack of sheets. When the contacting force of the pressure roller 18 is adjustable, the pressing force can be adjusted optimally to the thickness or height of the stack 22. The pressing force

is adjusted such that an increased pressure will act on the paper sheets 2 of the stack 22 in order to prevent accidental slipping or displacement of the paper sheets 2 relative to one another but such that the pressure acting on the sheets does not prevent the further transport of the stack 22 upon start-up of the stop rollers 13 to 16.

[0020] The paper sheet set 22 can be formed also by stacking the paper sheets 2 from below such that the ramp device has such a position that the trailing paper sheet 2 is placed underneath the previous paper sheet 2. In this case, the lower pressure roller 19 exerts a force onto the stack 22 while the upper pressure roller 18 provides an abutment.

[0021] While specific embodiments of the invention have been shown and described in detail to illustrate the inventive principles, it will be understood that the invention may be embodied otherwise without departing from such principles.